Cell Proliferation Involving pakE Gene in *Dictyostelium* amoeba

I spoke with Dr. Jeff Hadwiger, a scientist researching the *Dictyostelium* amoeba. Dr. Hadwiger's lab has worked for decades better to understand the *Dictyostelium* amoeba, inside and out. *Dictyostelium* amoeba is typically soil-dwelling, nonpathogenic, microscopic creatures. They typically feed on bacteria around them and undergo several forms throughout their lifecycle, including slug, pre-spore, and stalk formations. Most of the formations occur during cell proliferation when the amoeba transforms into a spore for preservation.

Several projects and students have gone, but Dr. Hadwiger remains dedicated to his craft. The lab is working to understand better cell signaling pathways, with most projects centered on understanding the processes and what elements participate in chemotaxis and cell proliferation. These functions activate two mitogen-activated protein kinases (MAPKs), Erk1 and Erk2 (Hadwiger et., al). MAPKs are activated by mitogen-activated protein kinase kinases or MAP2Ks. Through research, Dr. Hadwiger has concluded that Erk1 is activated by a MAP2K referred to as MekA, but the activation factor of Erk2 remains a mystery to this day (Hadwiger et., al).

After analyzing the multitude of protein kinases in the *Dictyostelium* amoeba, the decision was made to pursue the protein kinase pakE as a possible MAP2K of Erk2. The lab went through several processes of sequencing, gene disruption, and phenotype analysis before determining that pakE is not the MAP2K of Erk2. However, in a recent discovery, they found something cool.

Although pakE has been determined to not be the MAP2K, there is still a lot more to learn about what it does, so an experiment was performed to determine where pakE, and another protein kinase, pakF, are oriented when the amoeba begins its transformation into a stalk during cell proliferation. During this experiment, the cells that have been electroporated so that the pakE gene is fluoresced are mixed with wild-type cells and then starved. In pakE formation, we notice a concentrated amount of cells at the front of the slug with a small dark spot. Interestingly, when they repeated the same experiment with pakF, we noticed a concentrated amount of fluoresced cells in the spot that is dark for the pakE formation.

The exact cellular mechanisms of this discovery are currently unknown, and more research is needed to understand why this is. However, it is a cool discovery because now we know that the pakE protein kinase plays a role in phenotype and development, which means that the other proteins in the pak- family could also.

References:

Hadwiger, J. A., Cai, H., Aranda, R. G., & Fatima, S. (2022). An atypical MAPK regulates translocation of a GATA transcription factor in response to chemoattractant stimulation. *Journal of Cell Science*, *135*(16). https://doi.org/10.1242/jcs.260148